

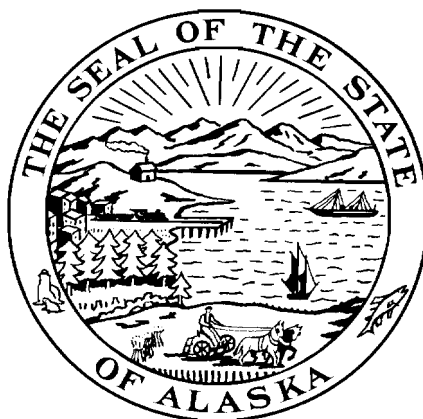
Volume 7

1965-1966

70  
SH  
11  
.A73  
14  
V. 7

STATE OF ALASKA

William A. Egan, Governor



ANNUAL REPORT OF PROGRESS, 1965 - 1966

FEDERAL AID IN FISH RESTORATION PROJECT F-5-R-7

SPORT FISH INVESTIGATIONS OF ALASKA

ALASKA DEPARTMENT OF FISH AND GAME  
Walter Kirkness, Commissioner

E. S. Marvich, Deputy Commissioner

Alex H. McRea, Director  
Sport Fish Division

Louis S. Bandirola, Coordinator

3 3755 000 85583 3

**ARLIS**

Alaska Resources  
Library & Information Services  
Anchorage, Alaska

Merged with  
**A.R.J.I.S.**  
UNIVERSITY AND ALASKA  
ARCTIC ENVIRONMENTAL INFORMATION  
AND DATA CENTER  
707 A STREET  
ANCHORAGE, ALASKA 99501

## INTRODUCTION

This report of progress consists of Job Segment Reports conducted under the State of Alaska Federal Aid in Fish Restoration Project F-5-R-7, "Sport Fish Investigations of Alaska."

The project during this report period is composed of 18 separate studies. Some are specific to certain areas, species or fisheries, while others deal with a common need for information. Each job has been developed to meet the needs of various aspects of the State's recreational fishery resource. Seven jobs are designed to pursue the cataloging and inventory of the numerous State waters. These jobs, which are of a continuing nature, will eventually index the potential recreational fisheries. Four jobs are directed toward specific sport fish studies. These include specialized efforts toward the anadromous Dolly Varden of Southeastern Alaska, the silver salmon in Resurrection Bay, the king salmon stocks on the Lower Kenai Peninsula, the king salmon stocks in Upper Cook Inlet, and the Arctic grayling of the Tanana River system.

The statewide access program is developing rapidly. Our efforts in investigating existing and potential recreational sites and access has resulted in favorable action being taken on our proposals and recommendations submitted to the land management agencies at both the State and Federal levels.

The remaining jobs included a specialized creel census effort in Southeastern, an egg-take program designed to establish indigenous egg-take sources, and evaluation of the Fire Lake system.

Three special reports have been completed from past studies on the Dolly Varden study. These appear in the Department's "Research Report" series and are a direct result of the Federal Aid In Fish Restoration Program. To date, the following reports have been published: Research Report No. 3, "Some Migratory Habits of the Anadromous Dolly Varden Salvelinus malma (Walbaum) in Southeastern Alaska," 1965, Robert H. Armstrong; Research Report No. 4, "Annotated Bibliography on the Dolly Varden Char," 1965, Robert H. Armstrong; and Research Report No. 5, "Age and Growth of Anadromous Dolly Varden Char Salvelinus malma (Walbaum), in Eva Creek, Baranof Island, Southeastern Alaska," 1966, David W. Heiser.

The material contained in this progress report is often fragmentary in nature. The findings may not be conclusive and the interpretations contained herein are subject to re-evaluation as the work progresses.

## RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.  
Project No.: F-5-R-7 Title: Salmonoid Rearing and Migration Study: Fire Lake System.  
Job No.: 9-C-1

Period Covered: March 1, 1965 to March 1, 1966.

## ABSTRACT

Prior studies conducted by the Sport Fish Division, Volumes 2, 3, 4 and 5, Dingell-Johnson Reports, 1961-65, State of Alaska, were reviewed. This investigation is a continuation of these prior studies.

Screens were placed in the weir traps on Fire Creek near Fire Lake Hatchery and on the outlet of Lower Fire Lake on April 1, 1965.

Anadromous and migrating salmonoid species were captured at the traps, enumerated, measured, fin clipped and released in the direction of migration.

The upstream trap at the hatchery captured 41 mature rainbow trout, Salmo gairdneri (Richardson), migrating from Lower Fire Lake to Fire Creek. These fish were held until ripe and then spawned.

The peak of the silver salmon, Oncorhynchus kisutch (Walbaum), smolt out-migration from Lower Fire Lake occurred in June. The peak of in-migration of young-of-the-year silver salmon was in August and the peak of in-migration of immature rainbow trout to Lower Fire Lake occurred in September.

Two thousand marked silver salmon fingerlings were stocked in both Upper Fire Lake and Lower Fire Lake in August, 1965. When field work was terminated in October, none of the marked fish had been captured at either the hatchery weir trap or at the Lower Fire Lake weir trap.

Upper and Lower Fire Lakes were test netted during September.

Water analysis was carried out on Upper Fire Lake throughout the year.

Foot surveys of Lower Fire Creek during the summer and fall were conducted to enumerate spawning salmon and to check on barriers (mostly beaver dams) to fish migration.

Lower Fire Lake was surveyed in early January, 1966 and a volumetric map was made.

#### RECOMMENDATIONS

1. It is recommended that this study be continued to obtain additional data on the migratory characteristics of the various salmonoid species found in the Fire Lake and Ship Creek system. Lower Fire Creek should be inspected annually to assure that no barriers to fish migration develop, and areas where stream improvement could be made should be mapped for future action.
2. It is recommended that Upper Fire Lake be rehabilitated during August with 1.5 PPM rotenone and restocked with 15,000 silver salmon and 5,000 rainbow trout.
3. It is further recommended that both Upper and Lower Fire Lakes be stocked annually with marked silver salmon to compare survival and growth in the two lakes and to establish a spawning run for egg-taking purposes.

#### OBJECTIVES

1. To evaluate the lake rearing and migratory characteristics of various salmonoid stocks in the Fire Lake system.
2. To determine the suitability of the stocks for use in the various aspects of the sport fish management program.
3. To provide information pertinent to fish population productivity.

#### TECHNIQUES USED

The screens and stop logs were installed at the hatchery weir trap and on Lower Fire Lake outlet weir traps on April 1. The traps were checked daily, cleaned, and all trapped fish enumerated, fin clipped and released in direction of migration. The screens and stop logs were removed on October 18, 1965.

Seaward-migrating silver salmon and in-migrating rainbow trout were sampled periodically for length data. All seaward-migrating silver salmon were marked by removal of the adipose fin for identification of these fish when they return as mature fish.

Silver salmon stocks in the Fire Creek System have been greatly reduced in recent years. In an effort to increase the spawning stocks, 2,000 silver salmon were marked by the removal of the left ventral fin and planted in Upper Fire Lake, and 2,000 right ventral fin marked silver salmon were stocked in Lower Fire Lake so as to discriminate between returning fish of hatchery origin.

Upper and Lower Fire Lakes were sampled using a standard 125-foot variable mesh gill net.

Water samples were taken from Upper Fire Lake each month during the year. A Hach colorimeter was used for dissolved oxygen and pH analysis and the standard titration method was used for CO<sub>2</sub> determinations.

Lower Fire Lake was surveyed during January, 1966. Equipment used consisted of plane table, steel chain, power ice auger and hand line for depth determinations.

## FINDINGS

### Hatchery Trap

Screens with 1/4-inch mesh were installed in the control structures next to the hatchery on April 1, 1965 (Figure 1). These traps were checked daily. The first mature rainbow trout entered the upstream trap on May 2. The last rainbows were captured May 20 in the upstream hatchery trap.

Ten females were ripe on May 21 and 15,708 eggs were obtained for an average of 1,570 eggs per female. The eggs were fertilized and then placed in Heath incubators at the Fire Lake Hatchery. Weights and fork lengths of the rainbow held for spawning were recorded (Table 1).

TABLE 1 - Lengths and Weights of Rainbow Trout from the Upstream Trap on Upper Fire Creek, May 1-20, 1965.

<u>Sex</u>	<u>No. of Fish</u>	<u>Mean Fork Length in Inches</u>	<u>Length Range</u>	<u>Mean Weight in Pounds</u>	<u>Weight Range</u>
Male	29	11.6	8.2-15.6	.6	.07-1.9
Female	12	15.1	10.5-23.6	1.7	.7-3.9

Relatively few fish of all species were captured in the upstream trap next to the hatchery. The trap was in continuous operation from April 1 through October 1, 1965, when high water forced removal of the trap screens. During this period, 59 fish were captured, of which 41 were spawning rainbows, 13 were silver salmon juveniles and 1 was a Dolly Varden, Salvelinus malma (Walbaum). In the same period the hatchery downstream trap captured 50 silver salmon smolts, 84 rainbow trout juveniles and 2 Dolly Varden. Due to the small number of fish taken, no length data were collected.

### Lower Fire Lake Trap

The downstream trap at Lower Fire Lake control structure was operated from April 1 to October 18, 1965. In total, 1,028 silver salmon, 236 rainbow trout and 12 Dolly Varden were checked through the trap during this period (Table 2). The peak seaward migration of silver salmon smolts occurred during June with 703 smolts passing through the traps (Figure 2). The peak period for downstream movement of

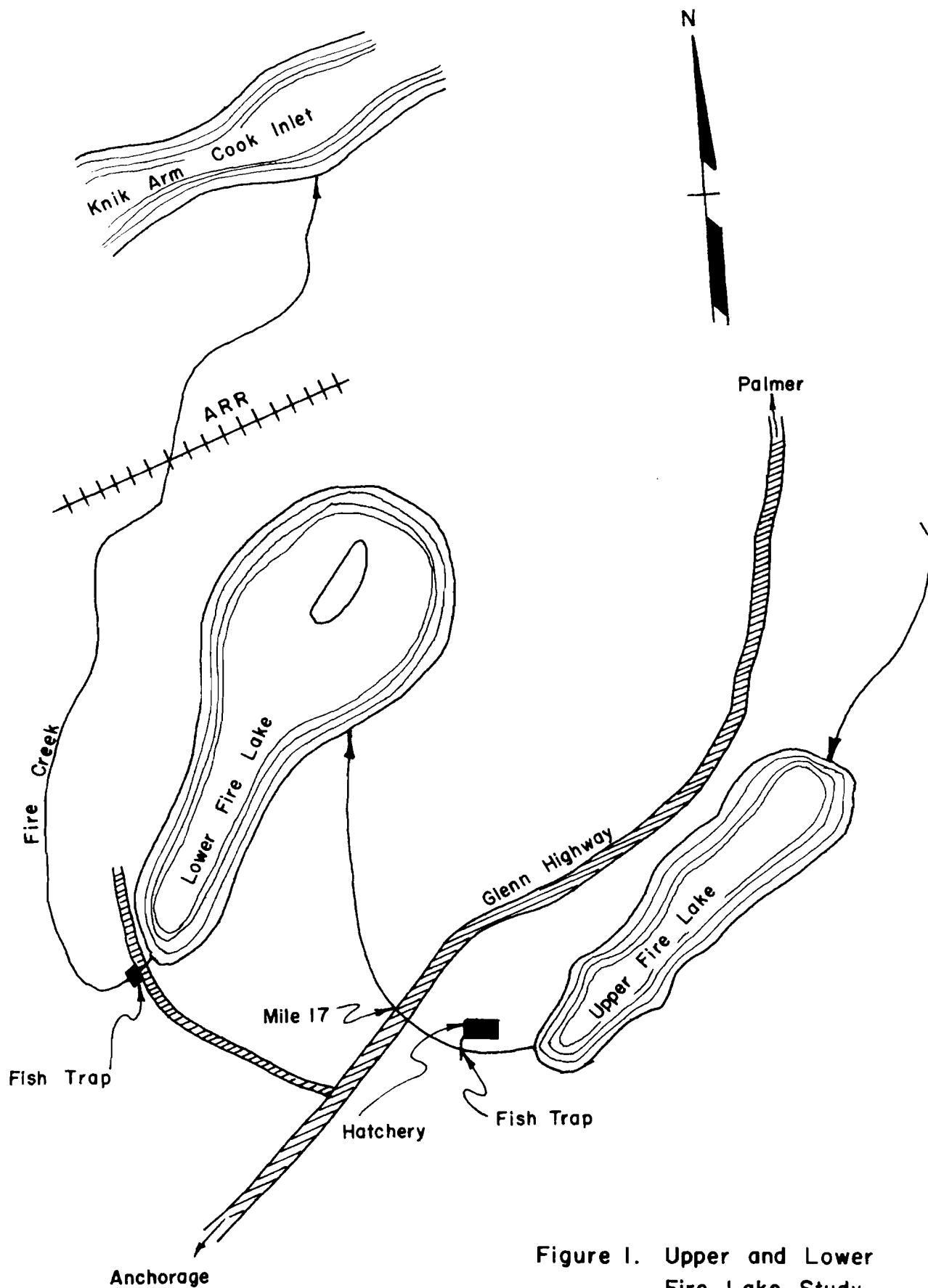
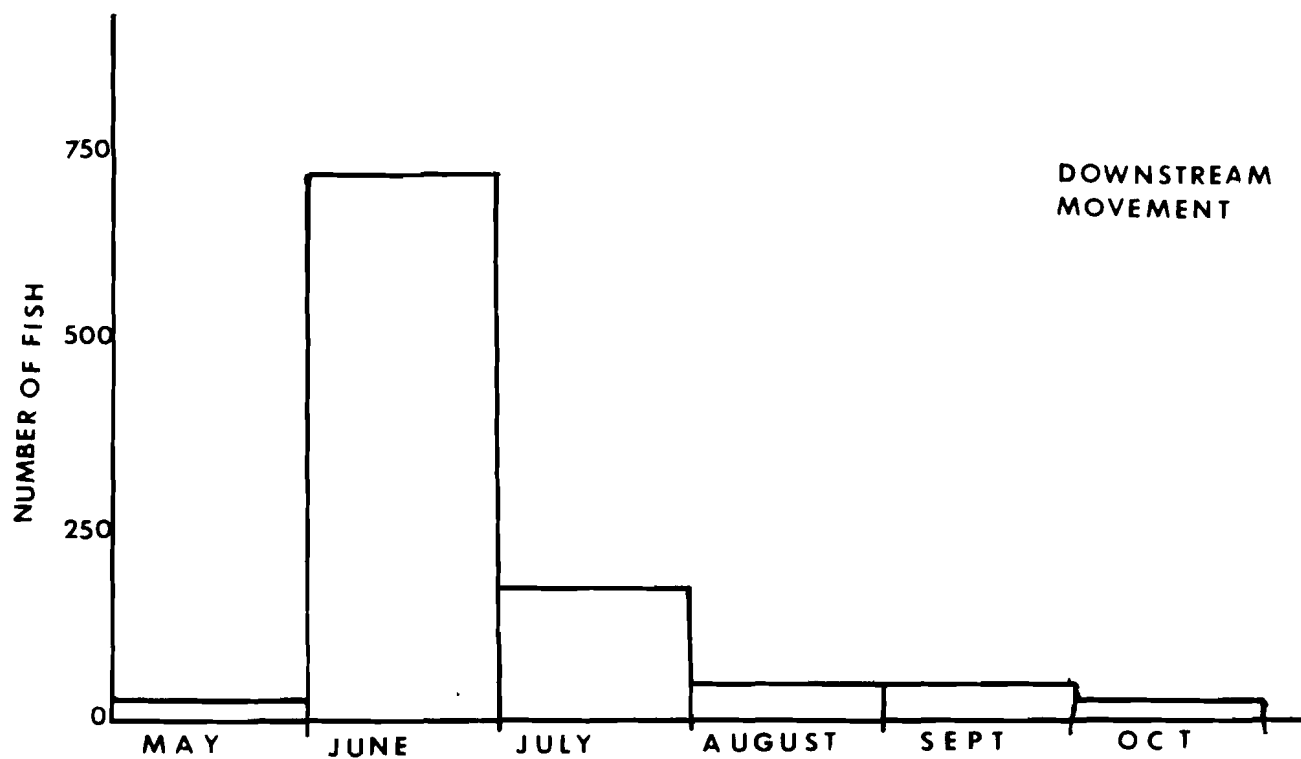
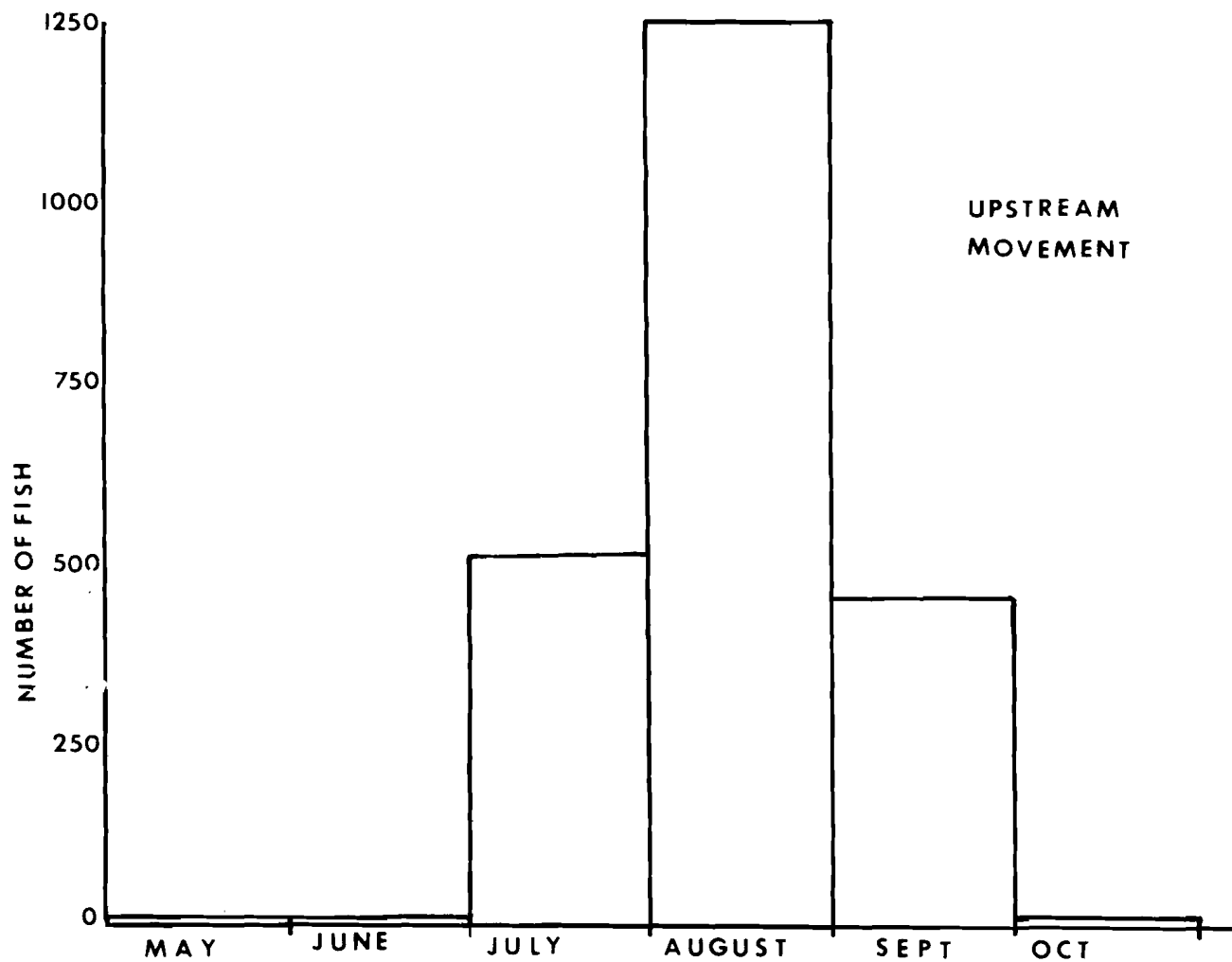


Figure 1. Upper and Lower Fire Lake Study Area

TABLE 2 - Number of Fish Moving Through the Trap at Lower Fire Lake, May-October, 1965.

<u>Species</u>	<u>Months</u>											
	<u>May</u>		<u>June</u>		<u>July</u>		<u>August</u>		<u>September</u>		<u>October</u>	
	<u>Up- Stream</u>	<u>Down- Stream</u>	<u>Up- Stream</u>	<u>Down- Stream</u>	<u>Up- Stream</u>	<u>Down- Stream</u>	<u>Up- Stream</u>	<u>Down- Stream</u>	<u>Up- Stream</u>	<u>Down- Stream</u>	<u>Up- Stream</u>	<u>Down- Stream</u>
Silver Salmon	25	25	30	703	518	175	1,250	50	450	50	25	25
Rainbow Trout	30	10	40	18	140	10	80	68	230	110	10	20



**FIGURE 2** MIGRATORY PATTERNS OF SILVER SALMON JUVENILES AT THE LOWER FIRE LAKE TRAP



rainbow trout occurred in September when 104 were captured, (Figure 3). Dolly Varden movements were irregular with no defined peak in downstream movement. A sample of 515 silver salmon was measured for length frequencies at the downstream trap (Table 3). The salmon smolts averaged 4.9 inches in length with a range from 1.5 to 7.0 inches.

The upstream trap at Lower Fire Lake was operated 201 days (April 1 to October 18). During this period, 2,193 silver salmon, 525 rainbow trout and 148 Dolly Varden were captured. The peak in upstream migration of silver salmon juveniles occurred during August when 1,251 fish were counted (Figure 3). The majority of these fish were young of the year migrating into the lower lake. The peak of the rainbow trout upstream migration was during September when 228 fish were captured (Figure 3). A sample of 192 rainbow was measured for length frequencies (Table 4). These fish averaged 5.0 inches with a range of 2.5 to 7.0 inches. The Dolly Varden again displayed an irregular pattern of migration; however, they did show a preference for spring and fall movements with 20 passing the weir in June and 82 passing in September.

During August, 4,000 hatchery-reared silver salmon fingerlings were fin clipped. Two thousand fish received a right ventral clip and 2,000 received a left ventral clip. The left ventral marked fish were released in Upper Fire Lake and the right ventral marked fish were released in Lower Fire Lake. Careful inspection of all fish passing the traps during September failed to turn up any of these marked fish.

Lower Fire Creek was surveyed periodically during August and September. Only two adult silver salmon were observed. These fish, both males, entered the upstream trap at Lower Fire Lake on September 28 and were passed over into Lower Fire Lake.

On September 28, 125-foot gill nets were set in both Upper and Lower Fire Lakes. The nets were pulled on September 29. Four rainbow, 6.9 to 9.1 inches long and one silver salmon, 4.6 inches long, were caught in Upper Fire Lake. The net pulled from Lower Fire Lake contained five rainbow, 12.4 to 19.1 inches long, and one silver salmon that was 5.1 inches long.

#### Water Analysis

Water samples were collected from Upper Fire Lake throughout the year. Samples were taken from five depths; tests for dissolved oxygen and pH were conducted using a Hach direct reading colorimeter. Carbon dioxide concentrations were determined by titration. Snow and ice cover and water temperatures were also recorded on each sample date. A summary of the various tests is given in Table 5.

#### Volumetric Survey of Lower Fire Lake

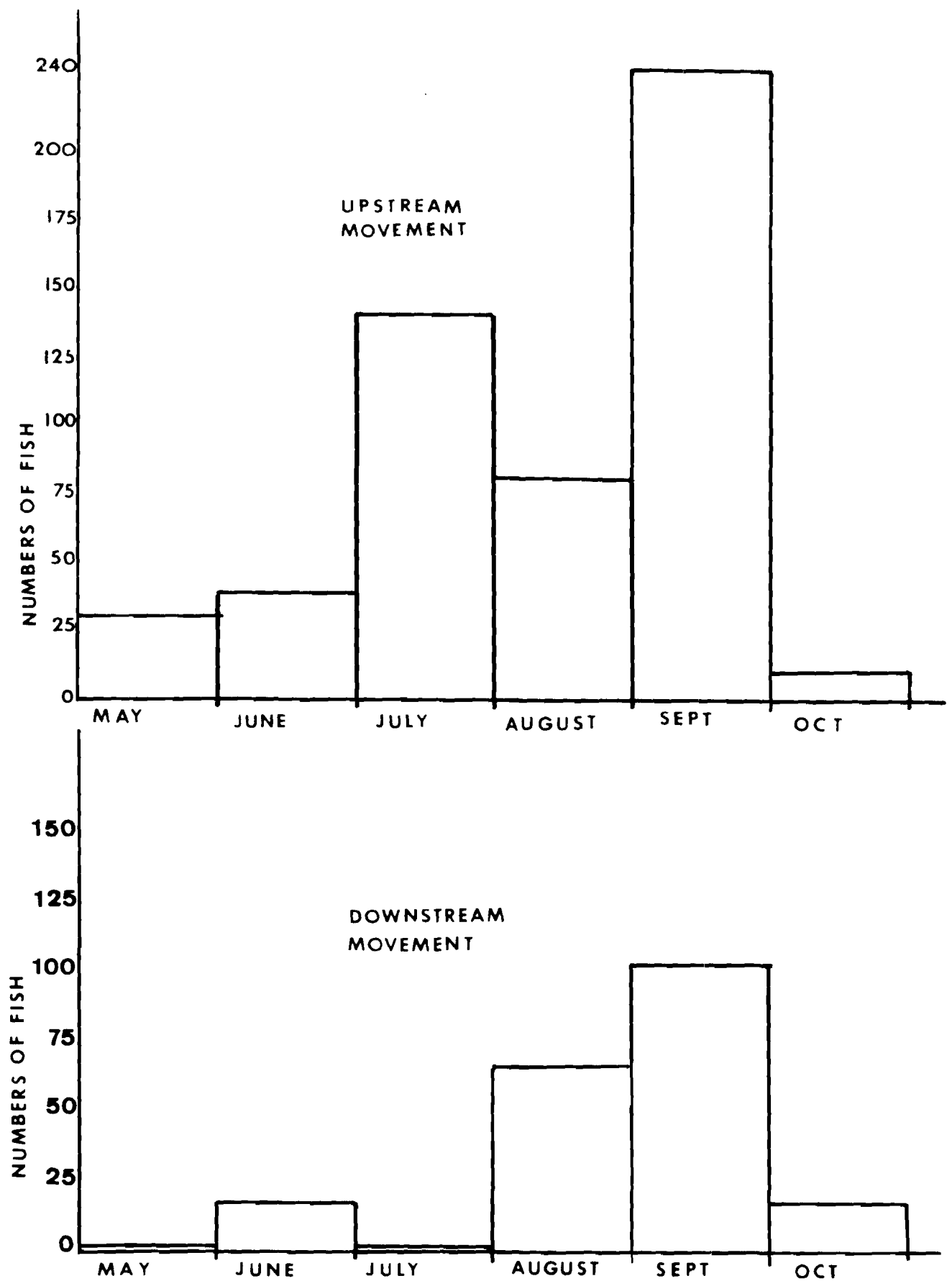
Winter time surveys of lakes for volumetric mapping has many advantages over a survey of the same lake during the summer. The ice provides an even, stable surface to work on and distance measurements can be made with a high degree of accuracy. During the winter, the exact depth can be obtained from any portion of the lake, whereas

TABLE 3 - Length Frequency of Juvenile Silver Salmon Collected at the Downstream Trap at Lower Fire Lake, May 1 - August 31, 1965.

<u>Fork Lengths In Inches</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>
1.5-2.0	0	18	4	1
2.1-2.5	0	1	7	2
2.6-3.0	0	0	4	2
3.1-3.5	0	8	7	4
3.6-4.0	1	9	12	6
4.1-4.5	2	12	6	9
4.6-5.0	6	72	1	4
5.1-5.5	1	147	0	6
5.6-6.0	1	142	2	2
6.1-6.5	0	11	0	0
6.6-7.0	<u>0</u>	<u>5</u>	<u>0</u>	<u>0</u>
TOTAL	11	425	43	36

TABLE 4 - Length Frequency of Juvenile Rainbow Trout Collected from the Upstream Trap at Lower Fire Lake, June, July and September, 1965.

<u>Fork Length In Inches</u>	<u>June</u>	<u>July</u>	<u>August</u>
1.5-2.0			
2.1-2.5			
2.6-3.0	1		
3.1-3.5	5	9	4
3.6-4.0	5	15	5
4.1-4.5	3	16	15
4.6-5.0	4	20	30
5.1-5.5	2	7	15
5.6-6.0	2	14	10
6.1-6.5	1	1	3
6.6-7.0	1	2	2



**FIGURE 3** MIGRATORY PATTERNS OF RAINBOW TROUT JUVENILES AT THE LOWER FIRE LAKE TRAP

TABLE 5 - Water Analysis from Five Depths in Upper Fire Lake, March 12, 1965-January 14, 1966.

Date	Depth in Feet												
	0					5				10			
	Ice Cover	Temp.	DO	CO <sub>2</sub>	pH	Temp.	DO	CO <sub>2</sub>	pH	Temp.	DO	CO <sub>2</sub>	pH
3/12/65	31"	33°	5.7	--	7.1	34°	5.2	--	7.0	35°	4.9	--	6.9
3/24/65	30"	34°	8.1	8.0	7.0	35°	7.8	8.0	7.1	37°	6.9	9.0	7.0
4/8/65	20"	36°	9.0	8.0	7.1	38°	7.6	16.0	7.0	40°	6.5	14.0	6.9
4/24/65	8"	36°	5.0	11.0	7.1	45°	5.5	10.0	7.2	44°	5.5	10.5	7.2
5/6/65	--	40°	9.0	15.1	6.9	40°	8.9	10.0	7.0	40°	8.9	9.0	7.1
6/4/65	--	52°	11.0	11.0	7.6	50°	11.2	9.1	8.2	50°	10.8	10.0	8.1
6/22/65	--	50°	11.1	12.0	7.0	50°	11.3	12.0	7.0	50°	11.3	12.0	7.0
7/3/65	--	57°	11.5	11.7	7.5	57°	11.3	11.6	7.3	57°	11.0	11.3	7.7
7/31/65	--	64°	9.5	15.0	7.6	62°	9.5	14.0	7.6	61°	10.5	15.0	7.8
8/9/65	--	60°	11.0	8.0	7.0	60°	9.5	8.0	7.0	58°	10.0	8.0	7.0
8/25/65	--	54°	9.2	8.0	7.2	54°	9.2	8.0	7.2	53°	10.0	8.0	7.2
9/27/65	--	49°	8.1	6.0	7.0	48°	8.1	6.0	7.0	48°	8.0	5.0	7.1
10/14/65	--	38°	8.8	5.0	7.2	38°	8.5	5.0	7.2	39°	8.3	4.0	7.2
10/27/65	5"	32°	10.0	4.0	7.1	38°	9.5	4.0	7.1	38°	9.0	5.0	7.1
11/14/65	14"	34°	8.0	--	7.3	35°	8.8	10.0	7.5	36°	8.8	8.0	7.3
11/26/65	20"	33°	10.6	5.0	7.0	34°	9.8	8.0	7.0	36°	9.1	9.0	7.1
12/14/65	24"	33°	9.2	9.0	7.0	34°	8.5	10.0	7.1	36°	8.5	10.0	7.1
12/27/65	24"	33°	8.1	8.1	7.1	34°	7.5	9.2	7.1	36°	7.5	9.1	7.2
1/14/66	27"	33°	9.2	7.9	7.1	34°	9.0	7.9	7.0	36°	8.4	8.0	7.0

TABLE 5 (Cont.) - Water Analysis from Five Depths in Upper Fire Lake, March 12, 1965-January 14, 1966.

<u>Date</u>	15				20			
	<u>Temp.</u>	<u>DO</u>	<u>CO<sub>2</sub></u>	<u>pH</u>	<u>Temp.</u>	<u>DO</u>	<u>CO<sub>2</sub></u>	<u>pH</u>
3/12/65	37°	4.9	--	7.0	38°	3.8	--	7.0
3/24/65	40°	5.4	10.5	7.0	40°	5.0	7.5	6.9
4/8/65	40°	5.5	12.8	6.9	40°	6.2	12.1	7.0
4/24/65	44°	5.3	9.0	7.2	42°	6.4	11.5	7.1
5/6/65	42°	9.0	9.0	7.1	42°	8.5	8.0	7.0
6/4/65	48°	10.0	12.3	7.9	47°	10.0	10.0	7.9
6/22/65	50°	12.0	12.0	7.0	50°	11.8	12.0	7.0
7/3/65	57°	11.0	11.0	7.9	57°	10.8	12.1	7.0
7/31/65	60°	10.8	15.2	7.6	60°	11.3	14.8	7.6
8/9/65	58°	10.3	8.0	7.0	58°	11.0	8.0	7.0
8/25/65	53°	10.3	8.0	7.0	52°	11.0	8.0	7.0
9/27/65	48°	7.8	6.0	7.1	47°	7.7	6.0	7.1
10/14/65	39°	7.9	4.0	7.2	39°	8.5	4.0	7.2
10/27/65	38°	9.0	5.0	7.1	38°	9.0	4.0	7.1
11/14/65	37°	7.5	9.0	7.3	38°	7.8	11.5	7.3
11/26/65	38°	9.1	10.0	7.2	38°	8.9	10.0	7.2
12/14/65	38°	8.4	11.0	7.1	38°	8.4	11.0	7.1
12/27/65	37°	7.4	9.0	7.2	38°	7.4	9.0	7.2
1/14/66	37°	8.3	9.3	7.0	38°	7.8	10.1	6.9





FIGURE 4. Winter Survey of Lower Fire Lake.

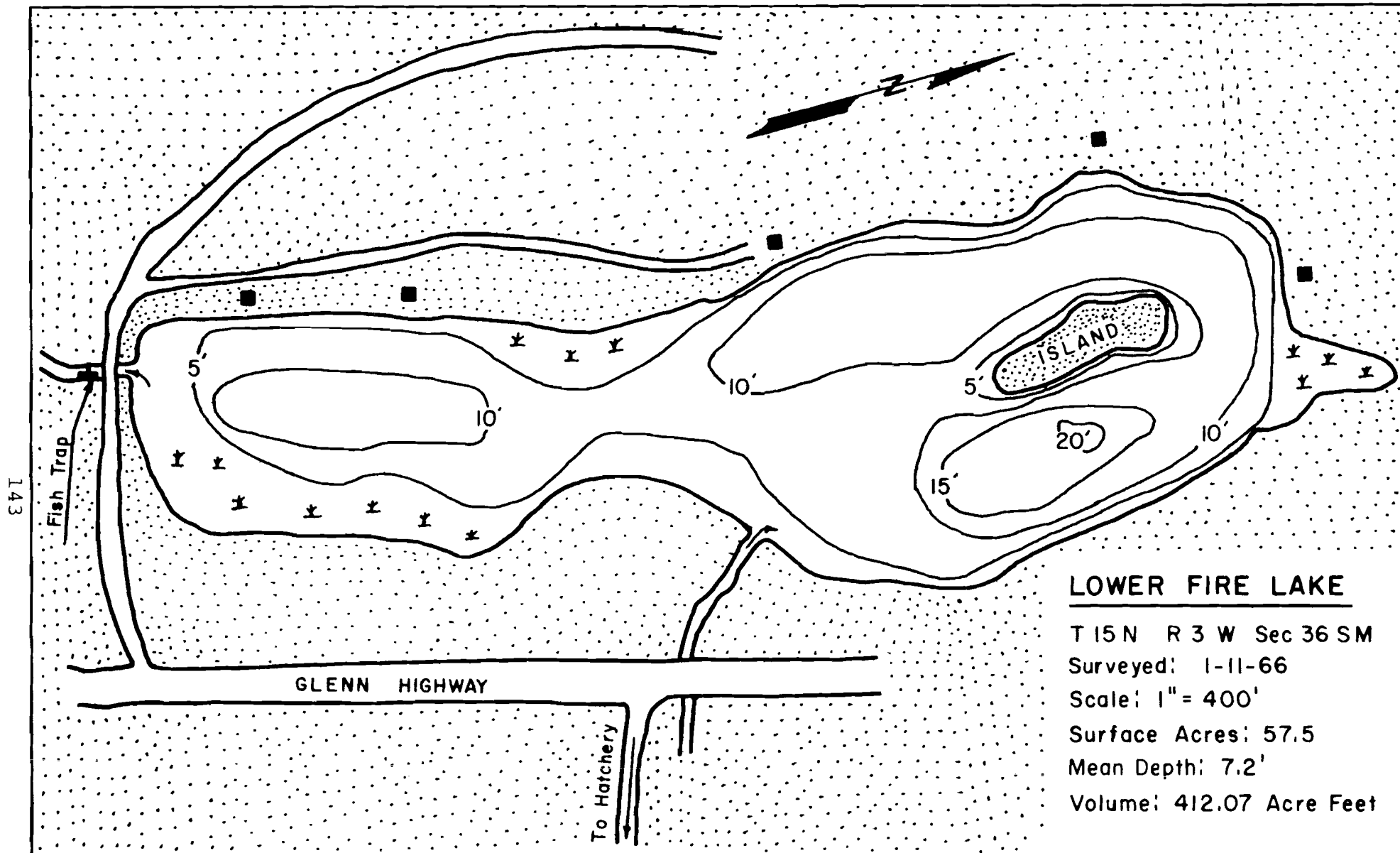


Figure 5. Lower Fire Lake



during the summer, boat movement makes precise length and depth measurements more difficult. One disadvantage of winter surveys has been the effort required to drill holes through thick ice by hand. With the new power augers now available this becomes an easy task as these augers will drill a 4- to 6-inch hole in 30 inches of ice in about 60 seconds.

The volumetric survey of Lower Fire Lake was completed on January 12, 1966 (Figure 4). A station was established at the south end of the lake and base line was determined. From there a center line was drawn the entire length of the lake. Stakes were set out every 200 feet on the center line. At each station a 90-degree turn was made both right and left and the distance to shore was measured with stakes set at 100-foot intervals. When the complete lake had been measured, the power auger was used to drill holes at each station. The depth was taken by use of a hand line and recorded on the map. Contour lines were then drawn on the map, and the surface acres and volumes were determined (Figure 5). A water level stake was placed near the outlet to mark the water level for future reference. The map was then completed by the addition of roads and cabin locations.

Prepared by:

Approved by:

Darwin E. Jones  
Fishery Biologist

s/ Louis S. Bandirola  
D-J Coordinator

Date: April 1, 1966

s/ Alex H. McRea, Director  
Sport Fish Division